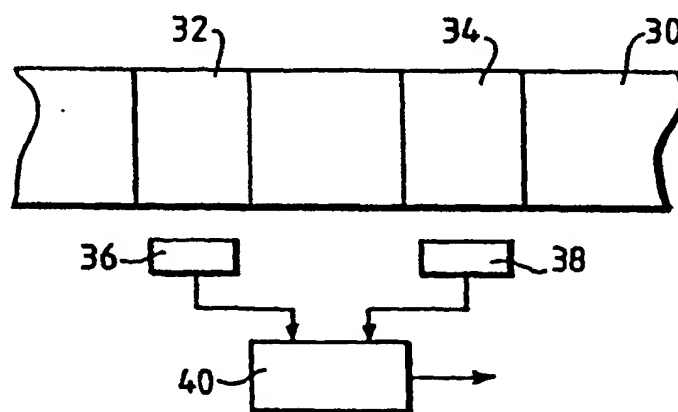




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : G01L 3/10	A1	(11) International Publication Number: WO 00/57150 (43) International Publication Date: 28 September 2000 (28.09.00)
(21) International Application Number: PCT/GB00/01103 (22) International Filing Date: 23 March 2000 (23.03.00) (30) Priority Data: 9906735.7 23 March 1999 (23.03.99) GB (71) Applicant (for all designated States except US): FAST TECHNOLOGY GMBH [DE/DE]; Otto Hahn Street 24, Gewerbegebiet Riemerling, D-85521 Ottobrunn (DE). (72) Inventors; and (75) Inventors/Applicants (for US only): MAY, Lutz, Axel [DE/GB]; 3 The Grange, Enborne, Newbury, Berkshire RG14 6RJ (GB). OWSLEY, John [GB/GB]; Hollymead House, Garden Close Lane, Newbury, Berkshire RG14 6PP (GB). (74) Agent: BLUFF, John, William; Lloyd Wise, Tregear & Co., Commonwealth House, 1-19 New Oxford Street, London WC1A 1LW (GB).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>

(54) Title: MAGNETISED TORQUE TRANSDUCER ELEMENTS



(57) Abstract

The problem of magnetoelastic circumferentially-magnetised torque transducers having a zero output magnetic field at zero torque is solved by pre-torquing. This entails circumferentially magnetising the transducer element at a predetermined torque. The technique is advantageously applied to a pair of transducer elements (32, 34; 62, 64) whose outputs are combined (Fig. 6a: 76) to provide a range of measurement of torque (clockwise and counterclockwise) including zero torque. Various combinations of direction of pre-torque and direction of circumferential-magnetisation are discussed. A circuit (Fig. 8) is disclosed for combining the signals to obtain a reference level (84) for gain control of the combined output signals V_o from the two transducer elements (60, 62). Also disclosed is the application of the invention to other forms of torque transducer element in which a magnetic field is stored. One form is longitudinal magnetisation (Fig. 10a). Another is radially spaced magnetisation (Fig. 12a: Fig. 13).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION <small>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</small>	
International application No. PCT/GB 00/ 01103	International filing date <i>(day/month/year)</i> 23/03/2000	(Earliest) Priority Date <i>(day/month/year)</i> 23/03/1999
Applicant FAST TECHNOLOGY GMBH et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☒ because this figure better characterizes the invention.

6

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 00/01103

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01L3/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 34 37 379 A (BENTLY NEVADA CORP) 25 April 1985 (1985-04-25)	1-3,7,9, 11-15, 17-20
Y	abstract; figures 2-4	10
A	page 15, line 3 -page 17, line 11 --- -/--	4-6,8, 16,21,22

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

8 June 2000

Date of mailing of the international search report

20/06/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Helm, B

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 00/01103

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HARADA K ET AL: "A new torque transducer using stress sensitive amorphous ribbons" PROCEEDINGS OF THE THIRD JOINT INTERMAG-MAGNETISM AND MAGNETIC MATERIALS CONFERENCE, MONTREAL, QUE., CANADA, 20-23 JULY 1982, vol. MAG-18, no. 6, pages 1767-1769, XP000606539 IEEE Transactions on Magnetics, Nov. 1982, USA ISSN: 0018-9464	1-3,7,9, 11-15, 17-20
A	abstract; figures 1,4,5	4-6,8, 16,21,22 10
Y	page 1768, left-hand column, last paragraph -page 1768, right-hand column, paragraph 3	
X	--- EP 0 321 662 A (KUBOTA LTD) 28 June 1989 (1989-06-28)	1-9, 11-22 10
Y	abstract; figures 1-10 column 5, line 34 -column 9, line 58	
Y	--- US 4 697 460 A (SUGIYAMA JUN ET AL) 6 October 1987 (1987-10-06) abstract; figures 1-6	10
A	column 4, line 29 -column 6, line 30 -----	1-9, 11-22

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/01103

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 3437379	A	25-04-1985	JP 60143735	A	30-07-1985
EP 0321662	A	28-06-1989	JP 1173842	A	10-07-1989
			JP 2085410	C	23-08-1996
			JP 7117463	B	18-12-1995
			JP 1173843	A	10-07-1989
			JP 1173844	A	10-07-1989
			JP 1173845	A	10-07-1989
			CN 1034615	A,B	09-08-1989
			CN 1060527	A	22-04-1992
			CN 1060528	A,B	22-04-1992
			CN 1060529	A	22-04-1992
			DE 3887853	D	24-03-1994
			DE 3887853	T	19-05-1994
			EP 0480912	A	15-04-1992
			KR 9311087	B	20-11-1993
			US 4920809	A	01-05-1990
			US 4972726	A	27-11-1990
			US 4972727	A	27-11-1990
			US 4972728	A	27-11-1990
US 4697460	A	06-10-1987	JP 1981189	C	25-10-1995
			JP 6072825	B	14-09-1994
			JP 61059232	A	26-03-1986